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STUDIES ON THE FORMOSAN SPHECIDAE (Ⅴ)  
THE SUBFAMILY SPHECINAE  
WITH SPECIAL REFERENCE TO THE GENUS *AMMOPHILA*  
IN EASTERN ASIA (HYMENOPTERA)

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STUDIES ON THE FORMOSAN SPHECIDAE (IV)  
THE SUBFAMILY SPHECINAE  
WITH SPECIAL REFERENCE TO THE GENUS *AMMOPHILA*  
IN EASTERN ASIA (HYMENOPTERA)\*

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During our collecting journey we got an impression that the members of the genera of the tribes Sphecini and Ammophilini were rather scarce in Formosa. The sole common and abundant Sphecine wasps were the males of *Sphex sericeus*. The females of this species were, however, not so abundant. Among other species *Sphex haemorrhoidalis* and *Ammophila clavus* were comparatively common, but anywhere they occurred rather scatteringly. As for other species of the two tribes all were very rare and it seemed to us strange that *Sphex argentatus* and *Sphex flammitrichus*, both very common and abundant in the Ryukyus, were represented by a quite scattered number of the individuals. Further, we failed to come across some of the species that had been known to occur in Formosa.

Therefore, the list of the species of our collection of the two tribes is of little interest, comprising only one new species and one new subspecies in the genus *Ammophila*.

On the other hand, the members of the tribe Sceliphronini were quite flourishing, though they are all common and well-known representatives.

*Sphex maurus* Smith could not be collected by us, but recently Mr. B. S. Chang, Kuangyin, Taiwan, kindly sent me two specimens with a prey collected by him on the Island of Botel Tobago. They were also recorded in this paper.

In connection with the specific problem lying between *Sphex umbrosus* Christ and *Sphex argentatus* Fabricius some data based on the comparative observation were also presented.

During my study with the Formosan specimens of *Ammophila* I was compelled to revise the species of the genus occurring in East Asia. It happened to raise a taxonomic question relative to a species living in Japan and Korea which appeared to be unsolvable at first. By a comparative study with the abundant material newly collected that were precisely recorded in regard to their microdistributional range, however, it turned out to be a probable instance of the interesting subspeciation in this genus. The result of my revision including the discussion on the speciation was given as an appendix in the present paper.

I express here my sincere thanks to Mr. B. S. Chang for his kindness in sending me the valuable specimens.

In the present paper the references to each species were restricted mainly to those relating to Formosa. That with an asterisk involves the detailed bibliography.

RECORDS AND DESCRIPTIONS OF THE SPECIES

I. GENUS *SPHEX* LINNE, 1758

1. *Sphex (Sphex) flammitrichus* Strand, 1913

*Sphex flammitrichus* Strand, Arch. Naturg., Abt. A, 1913 (3): 83, 1913 (Formosa).

\* Contribution No. 110 from the Biological Laboratory, Fukui University, Japan.

\* *Sphex (Sphex) flammitrichus*: Yasumatsu, Tenthredo, 2 (1): 61, 1938 (Japan, Ryukyus, Formosa).  
*Sphex (Sphex) flammitrichus*: Tsuneki, Life Study (Fukui), 6 (1): 6, 1962 (Amami-Ohshima); Kontyu, 35 (4): 382, 1967 (Formosa).

*Specimens collected*: 5 ♀♀ 5 ♂♂. 2 ♀♀, Taipei Pref. (Yangmingshan), 3. VII.; 2 ♀♀ 5 ♂♂, Taoyuan Pref. (Yangmei), 5, 6, VII.; 1 ♀, Hualien Pref. (Liyuchih), 14. VIII.

*Remarks*. We found some nests of this species at a nursery garden on the Hill of Yangmingshan. But the number of the working wasps was only a few in marked contrast to the enormous number of wasps usually found in the colony of this species in Japan and the Ryukyus.

## 2. *Sphex (Sphex) argentatus* Fabricius, 1787

*Sphex umbrosus*: Strand, Arch. Naturg., Abt. A, 1913 (3): 83, 1913; Ibid., 1915 (5): 89, 1915.

\* *Sphex (Sphex) umbrosus*: Yasumatsu, Tenthredo, 2 (1): 54, 1938.

*Sphex argentatus*: Yasumatsu, Spec. Bull. Lep. Soc. Jap., 1: 176, 1965 (Formosa).

*Sphex (Sphex) argentatus*: Tsuneki, Kontyu, 36 (4): 382, 1967 (Formosa).

*Specimen*: 1 ♀, Chiayi Pref. (Chuchi), 25. VII.

*Remarks*. Since Kohl (1890) this species has long been called *S. umbrosus* Christ. Recently J. Van der Vecht in his 'Hymenoptera Sphecoidea Fabriciana' corrected this error. According to him '*Sphex umbrosus* Christ was described from an unknown locality, the description is very poor, the type is lost, and Christ's figure applies much better to the African *Sphex metallicus* Taschenberg than to *S. argentatus* F'.

There are before me 1 ♀ 1 ♂ specimens of a species of the African *Sphex* which Dr. Van der Vecht considered most probably *S. umbrosus* Christ, together with 2 ♀♀ 2 ♂♂ of *S. argentatus* F. identified by him from Celebes and Java. I further possess 1 ♀ 1 ♂ *argentatus* specimens from India and a number of the same species from the Ryukyus. As he did not give any comparative description between the two species in question it will be of some use to attempt the comparison between them, although it is by no means to verify the validity of *umbrosus* Christ.

Comparative observations and measurements were made with the following characters:

The structure of the clypeus and antenna, ocellar location, spinosity of the front metatarsus, states and colour of pubescence etc.

Clypeus. ♀. Distance between the minute notches on anterior margin apparently greater in *umbrosus* (the African specimens are called such here) than in *argentatus*, but in the latter a more or less variation is observed and in some specimens it closely approaches the state of the *umbrosus*. Scanty material does not allow to draw any definite conclusion. ♂. In *umbrosus* anterior margin broadly emarginate, without process in middle, in *argentatus* (including subsp. *fumosus* Mocs.) similarly emarginate, but always with a minute tooth in middle.

Antenna. ♀♂. Relative length between joints, relative length to width of each joint, states of the rhinaria practically the same in both species, but the rhinaria appear slightly wider in *umbrosus*, but the difference rather slight and, moreover, in *argentatus* a more or less variation also observed.

Front metatarsus. It is provided with 11 spines on outer margin in *umbrosus*, ♀, while in *argentatus*, ♀, always 9 or 10 in number.

Pubescence. Pubescence on propodeum more brownish in *umbrosus* than in *argentatus* where in ashy-white.

In other characters any note worthy difference hardly observed.

According to the results the African specimens may fall within the category of *Sphex argentatus* and may be a geographical race. To settle the problem, however, the detailed comparative

morphological study on the population and the ecological evidence in the region where they are sympatric will be needed.

### 3. *Sphex (Sphex) haemorrhoidalis* Fabricius, 1781

- Sphex nigripes*: Strand, Arch. Naturg., Abt. A, 1913 (3): 81, 1913; Ibid., 1915 (5): 89, 1915.  
*Sphex luteipennis*: Sonan, Trans. N. H. Soc. Formosa, 17 (89): 131, 1927; Ibid., 17 (93): 376, 1927.  
 \* *Sphex (Sphex) haemorrhoidalis*: Yasumatsu, Tenthredo, 2 (1): 64, 1938.  
*Sphex haemorrhoidalis*: Van der Vecht, Zool. Verhandl. (Leiden), 48: 31, 1961.  
*Sphex (Sphex) haemorrhoidalis*: Tsuneki, Kontyu, 35 (4): 382, 1967 (Formosa).

*Specimens collected*: 39 ♀♀ 9 ♂♂. 20 ♀♀ 4 ♂♂, Taipei Pref. (15 ♀♀ 4 ♂♂, Yangmingshan, 3. VII.; 2 ♀♀, Wulai, 6. VII.; 2 ♀♀, Kueishanlu, 6. VII.; 1 ♀, Yangmei, 7. VII.); 9 ♀♀ 2 ♂♂, Nantou Pref. (4 ♀♀ 1 ♂, Puli, 8-15. VII.; 4 ♀♀ 2 ♂♂, Penpuchi, 11, 14. VII.; 2 ♀♀, Lihyuehtan, 8. VII.; 1 ♀, Wushe, 29. VIII.); 5 ♀♀ 2 ♂♂, Tainan Pref. (Kuantsuling, 19. VII.); 1 ♀, Pingtung Pref. (Kentin, 3. VIII.). 2 ♀♀, Chiayi Pref. (Chuchi, 22. VII.);

*Remarks*. In the Formosan specimens the tegulae of the wings brown, wings bright yellow with apex dark clouded and the legs except coxae and trochanters yellowish red. The tarsi are varied in colour from nearly wholly red to nearly wholly black. Thus, the population may be belonged to the typical form. In comparison with the Korean specimens they are markedly different in the bright colour of the wings.

This species is apparently widely distributed over the Island. We found a flourishing colony of the nesting wasps of this species at a nursery garden on the Hill of Yangmingshan.

### 4. *Sphex (Sphex) sericeus lineolus* Lepageletier, 1845

- Sphex aurulentus lepeletieri* Strand, Arch. Naturg., Abt. A, 1913 (3): 81, 1913 (Formosa).  
*Sphex aurulentus*: Strand, Ibid., 1915 (7): 19, 1915 (Formosa).  
*Sphex (Isodontia) rugosus*: Sonan, Trans. Nat. Hist. Soc. Formosa, 21 (112): 7, 1931 (Pescadores Is.).  
 \* *Sphex (Sphex) aurulentus*: Yasumatsu, Tenthredo, 2 (1): 69, 1938.  
*Sphex sericeus*: Vecht et Krombein, Idea, 10 (3): 35, 1955.  
*Sphex sericeus lineolus*: Tsuneki, Kontyu, 35 (4): 383, 1967 (Formosa).

*Specimens collected*: 29 ♀♀ 87 ♂♂. 4 ♂♂, Taoyuan Pref. (Yangmei, 6, 7. VII.); 8 ♀♀ 8 ♂♂, Ilan Pref. (Tsukeng, 19-22. VIII.); 1 ♂, Hualien Pref. (Tien-Hsiang, 17. VIII.); 8 ♀♀ 20 ♂♂, Nantou Pref. (Puli, 8-13. VII.); 1 ♀, Chiayi Pref. (Chuchi, 22. VII.); 1 ♀ 4 ♂♂, Taitung Pref. (1 ♀ 1 ♂, Chihpenchi, 13. VIII.; 3 ♂♂, Taoyeh, 14. VIII.); 11 ♀♀ 51 ♂♂, Pingtung Pref. (2 ♀♀ 28 ♂♂, Hengchun, 2-8. VIII.; 3 ♀♀ 15 ♂♂, Manchou, 4. VIII.; 5 ♀♀ 8 ♂♂, Ssuchungchi, 6. VIII.; 1 ♀, Uluampi, 5. VIII.).

*Remarks*. This species is common and abundant in Formosa. The females enter the human houses and dig their nests either under the floor or at the corner of the exposed ground.

### 5. *Sphex (Sphex) maurus* Smith, 1856

- Sphex maura* Smith, Cat. Hym. Ins. Brit. Mus., 4: 255, 1856 (Celebes).  
*Sphex maurus*: Bingham, Ann. Mag. Nat. Hist., VI, 16: 443, 1895 (Cape Engano, Luzon); Faun. Brit. India, Hym., 1: 247, 1897 (India).  
*Sphex (Sphex) sulciscutus*: Yasumatsu, Tenthredo, 2: 75, 1838 (Botel Tobago, Philippines).  
*Sphex maurus*: Baltazar, Pac. Ins. Monogr., 8: 344, 1966 (Philippines).

*Specimens examined*: 2 ♀♀, 12. VIII. 1967, Botel Tobago Is., B. S. Chang leg.

*Distribution*: Celebes, Amboina, Malay region, Burma, China, Philippines, Formosa (Botel Tobago Is.).

*Remarks*. The prey hunted by the wasp was an adult male of *Xenogryllus marmorata* de

Haan (Gryllidae).

### 6. *Sphex (Prionyx) viduatus* Christ, 1791

*Sphex viduatus*: Strand, Arch. Naturg., Abt. A, 1913 (3): 82, 1913; Ibid., 1915 (5): 90, 1915.

*Sphex (Parasphe) viduatus*: Sonan, Trans. Nat. Hist. Soc. Formosa, 19 (105): 533, 1929.

\* *Sphex (Parasphe) viduatus*: Yasumatsu, Tenthredo, 2 (1): 87, 1938.

*Sphex (Prionyx) viduatus*: Vecht, Zool. Verhandl., 48: 33, 1961.

*Sphex (Prionyx) viduatus*: Tsuneki, Kontyu, 35 (4): 383, 1967 (Formosa).

*Specimens collected*: 9 ♀♀ 5 ♂♂. 2 ♀♀ 3 ♂♂, Ilan Pref. (Tsukeng, 20. VIII.); 6 ♀♀ 2 ♂♂, Hualien Pref. (Liyuchih, 16. VIII.); 1 ♀, Taitung Pref. (Chihpen, 13. VIII.).

### 7. *Sphex (Isodontia) sonani* Yasumatsu, 1938

*Sphex (Isodontia) sonani* Yasumatsu, Tenthredo, 2 (1): 117, 1938 (♀♂, Formosa).

*Specimens collected*: 4 ♀♀ 10 ♂♂. 3 ♀♀, Nantou Pref. (Penpuchi, 13. VII.); 10 ♂♂, Taitung Pref. (Chulu, 12. VIII.); 1 ♀, Pingtung Pref. (Kentin-Kuonyuan, 7. VIII.).

*Remarks*. In the original description of the female 'Lower half of front and the entire surface of clypeus without prominent appressed silvery or golden pubescence'. But my four female specimens all possess the areas (except the anterior margin of the clypeus and supra-clypeal area) densely covered with short appressed golden pubescence. In the males also the areas is covered similarly with pile, but its colour is silvery.

Antennal joint 3 (♀) is 'about thrice as long as broad' in the key and in the description it is 'four times' so. In reality, it is approximately 3.5 times as long as wide at apex. Wings not clearer than in *nigellus*, but slightly darker. Probably the differences of the specimens observed by the original author from ours are due to the worn-out specimens.

This species is apparently rare in Formosa. Only three specimens have hitherto been collected:

1 ♂, Koshun, 29. IV. 1922, K. Takeuchi; 1 ♀, Tamaru, 1. IX. 1923, J. Sonan; 1 ♀, Taiko, 20. VII. 1930, J. Sonan.

### 8. *Sphex (Isodontia) nigellus* Smith, 1856

\* *Sphex (Isodontia) nigellus*: Yasumatsu, Tenthredo, 2 (1): 99, 1938 (no record on Formosa).

*Sphex (Isodontia) nigellus*: Tsuneki, Kontyu, 35 (4): 283, 1967 (Formosa).

*Specimens collected*: 2 ♀♀ 3 ♂♂, Taoyuan Pref. (Yangmei, 5. VII.); 4 ♀♀ 4 ♂♂, Ilan Pref. (Tsukeng, 22. VIII.); 2 ♂♂, Nantou Pref. (Wushe, 29. VIII.); 1 ♀ 4 ♂♂, Taitung Pref. (Chulu, 12. VIII.); 4 ♂♂, Tainan Pref. (Kuantsuling, 19. VII.).

*Remarks*. Hitherto rather vaguely reported to occur in Formosa. It is strange, however, there has been no record of the precisely identified specimen of this species from Formosa. Indeed, Yasumatsu (1938) did not deal with the Formosan specimen in his monographic study of this genus in East Asia.

### Other known species of *Sphex* in Formosa

We could not collect the following species which were recorded from Formosa by E. Strand (1913, 15) and K. Yasumatsu (1938):

*Sphex (Isodontia) formosicola* Strand, 1913.

3 ♀♀, Hoozan, IX. 1910, Sauter leg.; 1 ♀, Tainan (not coll. Sauter); 1 ♀, Chipon, 9. VIII. 1935, K. Iwata leg.

*Sphex (Isodontia) auriptygatus* Strand, 1913.



1 ♂, Kosempo, 7. VIII., Sauter leg.; 1 ♀, Fuhosho, VIII., Sauter leg.; 1 ♂, Horisha, 5. V. 1922, K. Takeuchi leg.

Further, *Sphex maurus* Smith was recorded from the Island of Botel Tobago.

## II. GENUS *AMMOPHILA* KIRBY, 1798

The descriptions of the new forms and the records of collection of each species will be given in the section dealing with *Ammophila* in eastern Asia.

### 1. *Ammophila clavus* (Fabricius, 1775)

*Ammophila atripes*: Matsumura, Thous. Ins. Jap. Suppl., 3: 119, 1911 (incl. Formosa).

*Ammophila clavus*: Sonan, Trans. Nat. Hist. Soc. Formosa, 17 (89): 132, 1927; *Ibid.*, 42 (222): 134, 1942 (Formosa).

*Ammophila japonica*: Yano, Icon. Ins. Jap., Ed. I: 284, 1932.

*Ammophila clavus*: Yasumatsu, *Ibid.*, Ed. II: 1743, 1950; Spec. Bull. Lep. Soc. Jap., 1: 176, 1965.

*Ammophila clavus*: Tsuneki, Kontyu, 35 (4): 383, 1967.

*Specimens collected*: 35 ♀♀ 65 ♂♂.

### 2. *Ammophila sickmanni wusheensis* subsp. nov.

*Specimens collected*: 2 ♀♀ 3 ♂♂.

### 3. *Ammophila formosana* sp. nov.

*Specimens*: 3 ♀♀ 9 ♂♂.

### 4. *Ammophila* (*Hoplammophila*) *aemulans rhinoceros* Strand, 1913 (conj. nov.)

*Ammophila rhinoceros* Strand, Arch. Naturg., Abt. A, 1913 (3): 85, 1913.

*Ammophila rhinoceros*: Sonan, Trans. Nat. Hist. Soc. Formosa, 32 (222): 136, 1942.

*Ammophila aemulans*: Tsuneki, Kontyu, 35 (4): 383, 1967.

*Specimens examined*: 2 ♂♂.

### 5. *Ammophila subassimilis* Strand, 1913

*Ammophila subassimilis* Strand, Arch. Naturg., Abt. A, 1913 (3): 86, 1913.

*Remarks*. As for this species see the section of '*Ammophila* in eastern Asia'.

## III. GENUS *SCELIPHRON* KLUG, 1801

### 1. *Sceliphron* (*Sceliphron*) *madraspatanum* (Fabricius, 1781)

*Sphex madraspatanum* Fabricius, Spec. Ins., I: 455, 1781.

*Sceliphron madraspatanum*: Klug, Ges. naturf. Fr. Berlin, 3: 565, 1804.

*Pelopeus tubifex* Latreille, Gen. Crust. Ins., 4: 61, 1809.

*Sceliphron kohli* Sickmann, Zool. Jahrb., Abt. Syst., 8 (2): 218, 1895 (N. China).

*Sceliphron madraspatanum*: Bingham, Faun. Brit. Ind., Hym., 1: 237, 1897.

*Sceliphron madraspatanum*: Matsumura, Thous. Ins. Jap., Suppl., 3: 119, 1911 (incl. Formosa).

*Sceliphron madraspatanum*: Strand, Arch. Naturg., Abt. A, 1913 (3): 84, 1913 (Formosa).

*Sceliphron* (*Pelopoeus*) *tubifex*: Kohl, Ann. k. k. Naturh. Hofmus. Wien, 32: 103, 1918.

*Sceliphron* (*Pelopoeus*) *madraspatanum*: Kohl, *Ibid.*, p. 109, 1918.

*Sceliphron madraspatanum*: Sonan, Zool. Mag. (Tokyo), 37 (440): 226, 1925 (Formosa, biol.); Trans. Nat. Hist. Soc. Formosa, 19 (105): 533, 1929 (listed, Pescadores Is.).

*Sceliphron tubifex*: Yano, Icon. Ins. Jap., Ed. 1: 286, 1932; *Ibid.*, Ed. 2: 1475, 1950.

*Sceliphron (Sceliphron) madraspatanum*: Iwata, Trans. Nat. Hist. Soc. Formosa, 29 (189): 169, 1939 (Formosa, biol.).

*Specimens collected*: 2 ♀♀, Taipei Pref.; 15 ♀♀ 8 ♂♂, Taoyuan Pref.; 13 ♀♀ 27 ♂♂, Ilan Pref.; 2 ♀♀ 2 ♂♂, Hualien Pref.; 6 ♀♀ 10 ♂♂, Nantou Pref.; 3 ♀♀ 4 ♂♂, Chiayi Pref.; 33 ♀♀ 7 ♂♂, Taitung Pref.; 7 ♀♀ 13 ♂♂, Pingtung Pref.; 1 ♀ 2 ♂♂, Botel Tobago Is., 11. VIII. 1967. B. S. Chang.

*Remarks*. This species is very common and abundant in Formosa.

## 2. *Sceliphron (Sceliphron) deforme* (Smith, 1856)

- \* *Sceliphron (Pelopoeus) deforme*: Kohl, Ann. k. k. Naturh. Hofmus. Wien, 32: 122, 1918.  
*Sceliphron deforme*: Sonan, Zool. Mag. (Tokyo), 37 (440): 235, 1925 (Formosa, biol.).  
*Sceliphron (Pelopoeus) deforme*: Sonan, Trans. Nat. Hist. Soc. Formosa, 17 (93): 376, 1927.  
*Sceliphron deforme*: Iwata, Trans. Nat. Hist. Soc. Formosa, 29 (189): 169, 1939 (Formosa, biol.).  
*Sceliphron deforme*: Yasumatsu, Spec. Bull. Lep. Soc. Jap., 1: 176, 1965 (Formosa, listed).

*Specimens collected*: 49 ♀♀ 18 ♂♂. 6 ♀♀ 16 ♂♂, Taipei Pref. (1 ♀, Yangmingshan, 3. VII.; 4 ♀♀ 16 ♂♂, Ulai, 4. VII.; 1 ♀, Kueishanlu, 6. VII.); 2 ♀♀, Ilan Pref. (Tsukeng, 19. VIII.); 1 ♀, Hualien Pref. (Tien-Hsiang, 17. VIII.); 2 ♀♀ 1 ♂, Nantou Pref. (Puli, 8. VII.); 1 ♀, Chiayi Pref. (Chuchi, 21. VII.); 1 ♀, Tainan Pref. (Kuantsuling, 19. VII.); 33 ♀♀ 1 ♂, Taitung Pref. (14 ♀♀, Chihpenchi, 13. VIII.; 19 ♀♀ 1 ♂, Chulu, 12. VIII.); 3 ♀♀, Pingtung Pref. (1 ♀, Manchou, 4. VIII.; 2 ♀♀, Ssuchungchi, 6. VIII.).

*Remarks*. The specimens of Formosa of this species belong to the southern typical race, gorgeously reddish brown and yellow maculated and with the wings broadly yellowish. Especially in the living insects the colour of reddish brown is very bright and glossy. While in the dried specimens the brownish colour loses the bright glittering tone and turns into lustreless brown (especially marked on the first tergite). The difference of the coloration from the much more fuscous specimens of Japan and Korea is quite marked. There is no doubt that each of the two populations belongs respectively to a separate geographic race.

In the Japanese specimens the yellow maculae are very much reduced and in some places completely lost. The legs are largely black and the brownish colour is without the bright reddish tone even in the living insects. Further, the wings are more fuscous, only with a faint yellowish tinge. The melanism is much more developed in the male specimens.

This subspecies was quite incompletely described in Japanese as var. *koreanum* by T. Uchida (1925) basing on 3 ♀♀ 1 ♂ Korean specimens in which the colour of the legs alone was dealt with as follows: Similar to the typical species, but the legs are dark brown to wholly black.

According to the observation of my collection of the Japanese and Korean specimens, these must be allocated within the same subspecific category. The detailed description of the coloration of *Sceliphron (Sceliphron) deforme koreanum* Uchida, 1925:

♀. Black; yellow are: A medium-sized anchor-shaped macula on clypeus, antennal joint 1 in front, a medianly interrupted band on pronotum, a spot on wing tegulae, a small elongate macula on upper subalar area of epicnemium, sometimes an additional spot near it, a small transverse macula on scutellum, a transverse macula on apical margin of propodeum just above base of petiole, apical margin of abdominal tergites 3, 4 and 5, and base of 6; legs with a narrow streak on front tibiae and the same at base only of mid tibiae. Brown to dark brown: Apical margin of clypeus, mandibles except base, tegulae largely, a medianly enlarged transverse macula on ante-apical area of abdominal tergite 1, apical margin of tergite 2, a broken line on sternite 5 and sternite 6 wholly, basal portion of all femora beneath and wing veins.

♂. Black. Yellow: A small spot on clypeus, maculae similar to those of ♀ on thorax-com-

plex, a narrow short bands on tergites 4, 5 and 6, narrow streaks similar to those of ♀ on front and mid tibiae. Brown: Antennal joint 1 in front, tegulae, sometimes a narrow band on tergite 1, basal 2/3 of hind femora beneath and wing veins.

## 2. *Sceliphron (Chalybion) inflexum* Sickmann, 1895

- Chalybion curvatum* Ritsema (nec Smith, 1870), Notes Leyden Mus., 2: 226, 1880 (Japan).  
 ? *Pelopeus japonicum* Gribodo, Ann. Mus. Civ. Stor. Nat. Genova, 18: 264, 1882.  
*Sceliphron (Chalybion) inflexum* Sickmann, Zool. Jahrb., Abt. Syst., 8 (2): 220, 1895 (N. China).  
*Sceliphron ritsemae* Dalla Torre, Cat. Hym. etc., 8: 389, 1897.  
*Chalybion japonicum* Pérez (nec Gribodo), Bull. Mus. Hist. Nat. Paris, 3: 152, 1905 (Japan).  
*Sceliphron violaceus*: Matsumura (nec Fabricius), Thous. Ins. Jap., Suppl., 3: 118, 1911.  
*Sceliphron ritsemae*: Strand, Arch. Naturg., Abt. A, 79 (7): 165, 1913; Ibid. 81 (5): 91, 1915.  
 \* *Sceliphron (Chalybion) inflexum*: Kohl, Ann. k. k. Naturh. Hofmus. Wien, 32: 62, 1918.  
*Chalybion violaceum*: Sonan (nec Fabricius), Zool. Mag. (Tokyo), 37 (440): 236, 1925 (biol.).  
*Sceliphron (Chalybion) inflexum*: Sonan, Trans. Nat. Hist. Soc. Formosa, 17 (93): 374, 1927.  
*Sceliphron inflexum*: Iwata, Ibid., 29 (189): 169, 1939 (Biol.).

*Specimens collected*: 20 ♀♀ 32 ♂♂. 3 ♀♀ 4 ♂♂, Taipei Pref. (1 ♀ 3 ♀♀, Kueishanlu, 6. VII.; 2 ♀♀ 1 ♂, Ulai, 4. VII.); 2 ♀♀ 6 ♂♂, Ilan Pref. (1 ♀ 5 ♂♂, Tsukeng, 19, 21. VIII.; 1 ♀ 1 ♂, Chuatou, 21. VIII.); 3 ♀♀ 1 ♂, Taoyuan Pref. (Yangmei, 6. VII.); 8 ♀♀ 20 ♂♂, Nantou Pref. (2 ♀♀ 4 ♂♂, Puli, 8, 17. VII.; 5 ♀♀ 14 ♂♂, Penpuchi, 13. VII, 30. VIII.; 1 ♀ 1 ♂, Chienchin, 12. VII.; 1 ♂, Wushe, 29. VIII.); 2 ♂♂, Chiayi Pref. (Chuchi, 21. VII.); 4 ♀♀ 1 ♂, Taitung Pref. (3 ♀♀ 1 ♂, Chihpenchi, 12. VIII.; 1 ♀, Chulu, 13. VIII.).

*Remarks.* (1) Notes on *Pelopoeus japonicum* Gribodo.

If the types (♀♂) of this species were really originated from Japan (s. str.) it must be identified with *Sceliphron inflexum* Sickmann, although Gribodo referred to the difference in the character of its abdominal petiole from *P. (Chalybion) curvatum* Ritsema (= *Sceliphron inflexum* Sickm.), since in Japan (s. str.) only a single species of *Chalybion* occurs. On the other hand, if they were derived from Japan (s. latr. incl. Formosa), it also is not *S. bengalense* Dahlbom, because Gribodo clearly explained that it was not *violaceus* (= *bengalense*), having the dark-violet wings and larger body size. Hence, Kohl (1918) placed *japonicum* Gribodo under the questionable species. Future study of the types is needed.

(2) Differences in characters from *S. bengalense* Dhlb.

This species appears similar to the said species and sometimes misidentified with it. Kohl (1918) in his redescription of *Sceliphron inflexum* Sickmann (♀) already alluded to the main differences between the two species in question which are as follows:

In *inflexum* the collar swelling of pronotum with a stronger impression in middle and the lateral grooves of the collar also deeper. Petiole of abdomen more strongly curved, propodeum without the white pile marks above hind coxae and the metapleuron without broad impressed glittering area.

Sonan (1925) also touched on the two distinguishing characters, one is the character of the abdominal petiole, the same as pointed out by Kohl, and the other concerns with the cloudiness of the wings: In *inflexum* wings is markedly darker.

By the differences in characters above cited the distinction between the two species can easily be made. For taxonomy, however, further differences can be added:

♀♂. (a) Clypeus more highly convex in *inflexum*, with the median carina much more distinct (even in small specimens, in spite of the negative remarks by the original author).

(b) Postocelli more strongly inclined laterally, thus in the dorsal view they are more



elongate than in *bengalense*.

(c) Punctures on frons and mesonotum finer and closer.

(d) In general much larger.

♂. (a) Rhinaria (glabrous smoothed, somewhat convexed impressions) on antenna defined on joints 10 and 11 only, in *bengalense* usually on joints 8, 9, 10 and 11.

(3) Distribution in Formosa.

During our journey we could find this species almost everywhere we went, excepting the high altitude (Alishan and above Sungkang) and the southernmost (Pingtung) Prefecture. As for the vertical distribution, however, it must be remembered that we captured some specimens at Chienchin and Wushe (more than 1000 m). As for horizontal distribution old record tells us that formerly the species was collected at Hengchun, southernmost location of the Island. Whether or not they do exist even now in the same region we can not say. But the southernmost record of capture of our specimens was Chihpen, a little south of Taitung. In Pingtung Prefecture this species is apparently replaced by the following species that is quite common and abundant there.

(4) Sonan (1925) corrected the species name, *violaceum* Fabr. misapplied up to that time to the present species. It is strange, however, that he apparently dealt with the Formosan *Chalybion* as a single species, although he himself referred to the differences between the two species concerned. In those days, however, had the other species, *S. bengalense*, not been known from Formosa?

(5) This species is widely distributed over East Asia, ranging from Japan (incl. the Ryukyus), Korea, East China broadly, Formosa to N. E. India (Assam and Sikkim).

#### 4. *Sceliphron (Chalybion) bengalense* (Dahlbom, 1845)

\* *Sceliphron (Chalybion) bengalense*: Kohl, Ann. k. k. Naturh. Hofmus. Wien, 32: 54, 1918.

*Sceliphron (Chalybion) bengalense*: Van der Vecht, Zool. Verhandl., 48: 41, 1961.

*Sceliphron bengalense*: Yasumatsu, Spec. Bull. Lep. Soc. Jap., 1: 176, 1965 (Formosa).

*Sceliphron (Chalybion) bengalense*: Tsuneki, Kontyu, 35 (4) (in press) (Formosa).

*Specimens collected*: 28 ♀♀ 64 ♂♂. 22 ♀♀ 58 ♂♂, Pingtung Pref. (3 ♀♀ 3 ♂♂, Man chow, 4. VIII.; 8 ♀♀ 22 ♂♂, Hengchun, 2. VIII.; 1 ♀ 3 ♂♂, Ssuehchungchi, 6. VIII.; 9 ♀♀ 22 ♂♂, Fangliao, 31. VII.; 1 ♀ 2 ♂♂, Oluampi, 5. VIII.; 6 ♂♂, Kentin, 9. VIII.); 1 ♀ 2 ♂♂, Taitung Phef. (2 ♂♂, Chulu, 12. VIII.; 1 ♀, Taitung, 11. VIII.); 1 ♂, Chiayi Pref. (Fenchihu, 26. VII.); 5 ♀♀ 3 ♂♂, Taoyuan Pref. (3 ♀♀, Yangmei, 30. VIII. 1966, B. S. Chang leg.; 2 ♀♀ 3 ♂♂, Kuangyin, 10. VIII, 4. IX. 1966, B. S. Chang leg.).

*Remarks*. During our journey we could not find this species other than the southern regions as above listed. So we believed that the species was confined in distribution to the areas. Later when I received a collection of wasps sent by Mr. B. S. Chang, however, I was surprised to find a series of specimens of this species collected in Taoyuan Prefecture. As I could not meet with this species when I visited the same locality in early July and the dates of his collection were in August and September, this species might appear later than the preceding species which were abundantly observed when I went there.

#### Appendix. GENUS *AMMOPHILA* OF EASTERN ASIA

In 1962 I attempted to arrange in a key the known species of *Ammophila* of Japan and Korea (Life Study, 6: 25). But at that time no particular investigation was made. In connection with the study of the Formosan species in the present investigation I had to examine the Korean species

and this again requested to reexamine the Japanese representatives. Thus, the species of the three regions came eventually to be comparatively studied. As a result some interesting new findings were brought about.

### 1. Key to the species of *Ammophila* of East Asia

- 1 Abdominal tergite 1 distinctly widened toward apex, not petioliform, with stigmata located toward middle of its length ..... 2
- Abdominal tergite 1 not or only slightly widened toward apex, distinctly petioliform, with stigmata located behind middle of its length ..... 4
- 2 Petiole nearly as long as tergite 1, upper vein of cubital cell 2 much longer than that of 3, mesopleuron without silvery pile patch, claws of legs unidentate near base (mesonotum with hairs fairly abundant, tergite 2 and greater part of tergite 3 yellowish red), length ♀ 18-22, ♂ 13-15 mm, the latter with lower frons and clypeus covered with silvery pile, Europe, N. Africa, Caucasus, E. Siberia and Korea (*Podalonia*) *affinis* Kirby, 1798
- Petiole distinctly longer than tergite 1, upper vein of cubital cell 2 about as long as that of 3, sometimes even shorter, mesopleuron with a distinct silvery pile patch, claws of legs bidentate near base, length ♀ ♂ 25-33 mm, most usually 30 mm or so, ♂ with lower frons and clypeus covered with golden or brassy pile and clypeus markedly triangularly produced anteriorly, with apex acute and slightly reflected
- (*Hoplammophila*) *aemulans* Kohl, 1901 ..... 3
- 3 Tergite 1, 4, sometimes 5 partly, red, 2 and 3 wholly red, glittering pilose patch on humeral angle and mesopleuron more developed, pile on collar of pronotum with brassy lustre. Formosa (*Hoplammophilla*) *aemulans rhinoceros* Strand, 1913
- Tergite 2 wholly and 1 in part red, glittering pile patch on mesopleuron smaller, less distinct, pile on humeral angle and collar of pronotum with only browish lustre in certain light. Japan, Korea and E. Siberia (*Hoplammophilla*) *aemulans aemulans* Kohl, 1901
- 4 ♀ (Lower frons and clypeus not densely covered with silvery pile, antenna 12-jointed) ... 5
- ♂ (Lower frons and clypeus densely covered with silvery or brassy or golden pile, antenna 13-jointed) ..... 15
- 5 Pronotum and mesonotum transversely strongly striate, legs large red
- (*Ammophila*) *clavus* (Fabricius, 1775) ..... 6
- Pronotum not strongly striate, legs black ..... 9
- 6 Fringe of long erect hairs on temples comparatively sparse (abdominal petiole 1 distinctly longer than petiole 2 (tergite 1)), length mostly 22-25 mm. S. and S. E. Asia
- (*Ammophila*) *clavus atripes* Smith, 1852
- Fringe of long erect hairs on temples comparatively close and much more distinct (abdominal petiole 1 nearly as long as petiole 2) ..... 7
- 7 Length mostly 30-33 mm (colour as in *taiwana*). Japan and Korea
- (*Ammophila*) *clavus japonica* Kohl, 1906
- Length mostly 22-25 mm ..... 8
- 8 Antennal joints 1-3, tegulae, petiole 1 wholly and 2 largely, sometimes tergite 2 partly or wholly red, trochanters of legs red. Australia
- (*Ammophila*) *clavus clavus* (Fabricius, 1775)
- Antennal joint 1 only, petiole 1 wholly, 2 except base, red; tergite 2 and trochanters always black. Formosa (*Ammophila*) *clavus taiwana* subsp. nov.

- 9 Apical black portion of abdomen without steel blue lustre, mesonotum mainly transversely and strongly striate (dorsal aspect of propodeum without median carina, broadly rugoso-reticulate, only on lateral portions obliquely striate; humeral angles, epimeral area of mesopleuron and latero-apical areas of propodeum with a distinct broad patch of brassy pile; IOD on vertex somewhat less than as long as antennal joints 2+3+4, petiole longer and slenderer than in subsequent group of species, usually its apex and tergites 1 and 2 red), length 17-19 mm. (IOD...Interocular distance)..... 10
- Apical black portion of abdomen with steel blue lustre, mesonotum not so strongly striate (at most less strongly punctate-rugoso-striate, inner orbits parallel, dorsal aspect of propodeum with a median carina) ..... 12
- 10 Supra-antennal lamellate projections less developed (inner orbits slightly convergent towards clypeus, lower frons and clypeus not covered with silvery pile). Formosa  
(*Ammophila subassimilis* Strand, 1913)
- Supra-antennal lamellate projections well developed and high  
(*Ammophila sickmanni* Kohl, 1901 ..... 11
- 11 Clypeus and lower frons not covered with silvery pile, inner orbits parallel, striae on mesonotum much stronger. N. China and Korea  
(*Ammophila sickmanni sickmanni* Kohl, 1901
- Clypeus and lower frons covered with silvery pile, inner orbits slightly convergent towards clypeus, striae on mesonotum much weaker. Formosa  
(*Ammophila sickmanni wusheensis* subsp. nov.
- 12 Supra-antennal lamellate projections less distinct, sometimes almost lacking (disc of pronotum generally somewhat shorter than in *infesta*, petiole 1 also relatively shorter than in this — less than 10 times as long as wide at its minimum width —, frontal excavation comparatively shallower, mesonotum more or less rugose, silvery pile patches on humeral angle, mesopleuron and posterior aspect of propodeum well developed, much more conspicuous, abdominal segment partly red), length 16-28 mm, mostly 22-26 mm. Europe, N. Africa and Siberia  
(*Ammophila sabulosa sabulosa* (Linné, 1758)
- Supra-antennal lamellate projections high and distinct, petiole 1 nearly 10 times as long as width at its minimum width, or even more than so ..... 13
- 13 Sides of lower frons and clypeus covered with silvery pile (covering not dense and in the worn-out specimens largely rubbed off, abdominal tergite 1 largely, 2 and 3 wholly red, silvery pile patch on mesopleuron large and distinct, petiole 2 somewhat more than 10 times as long as wide at its minimum width or as long as hind tarsal joints 1+2, mesonotum transversely punctate-striate), length 22-25 mm. Formosa  
(*Ammophila formosana* sp. nov.
- Sides of lower frons and clypeus not covered with silvery pile, abdominal tergite 3 not or only at base red, silvery pile patch on mesopleuron smaller, less distinctly outlined, sometimes vestigial or absent ..... 14
- 14 Mesonotum and mesopleuron finely sparsely punctured, mesopleuron as a rule without silvery pile patch, if present, very incomplete and vestigial (disc of pronotum generally well developed, longer, with anterior inclination steeper, tergite 2 largely or completely red, tergite 3 usually black), length 22-28 mm, mostly 23-25 mm, living in montane region in Japan, in Korea detailed distribution unknown  
(*Ammophila sabulosa infesta* Smith, 1873
- Mesonotum and mesopleuron more grossly, more closely punctate-rugose, mesopleuron as

a rule with silvery pile patch, sometimes fairly large and distinct, but sometimes vestigial (disc of pronotum comparatively shorter, with anterior inclination less steep, tergite 3 largely red, tergite 4 sometimes at base red), length 16-24 mm, most usually 20-24 mm, living usually in lowland area in Japan, in Korea microdistribution uninvestigated

(*Ammophila*) *sabulosa nipponica* subsp. nov.

- 15 Pro- and mesonotum transversely strongly striate, abdomen except petiole 2 beneath black, from tergite 2 apically with steel blue lustre (legs largely black, petiole 1 longer than 2 and amply as long as hind tarsal joints 1+2+3, upper vein of cubital cell 2 shorter than that of 3, dorsal aspect of propodeum medianly broadly rugoso-reticulate, without distinct medial carina) ..... 16  
 (Ammophila) *clavus* (Fabricius, 1775) ..... 16
- At least pronotum not so strongly striate, at least abdominal tergite 2 largely red ..... 17
- 16 Length 28-33 mm. Japan and Korea (Ammophila) *clavus japonica* Kohl, 1906  
 - Length 17-25 mm. Tropical and subtropical regions of Asia and Australia  
 (Ammophila) *clavus* (Fabricius), other subsp.
- 17 Apical black portion of abdomen without steel blue lustre, pure black (thorax-complex except dorsum of propodeum fairly closely covered with short velvety silvery or pale brassy pile, well visible in certain light, mesonotum transversely strongly striate, propodeum without medial carina) ..... 18  
 - Apical black portion of abdomen with steel blue lustre (thorax-complex without close short velvety pile, mesonotum not so strongly transversely striate, propodeum with a distinct medial carina, clypeus on anterior margin in middle without polished beveled area) ... 20
- 18 Supra-antennal lamellate projections not developed (silvery pile patches on humeral angle, mesopleuron and propodeum distinct), length 18-20 mm. Formosa  
 (Ammophila) *subassimilis* Strand, 1913  
 - Supra-antennal lamellate projections well developed and high (clypeus on anterior margin in middle with polished beveled area, silvery pile patches on humeral angle, mesopleuron and propodeum well developed, usually tergite 1, 2 and 3 except dorsal streak red, collar of pronotum roundly swollen, with extreme anterior portion vertical), length 18-20 mm  
 (Ammophila) *sickmanni* Kohl, 1901 ..... 19
- 19 Mesopleuron fairly closely punctate-rugose, pile on lower frons and clypeus brassy or silvery, short brassy covering pile on thorax-complex less distinct, Korea and N. China  
 (Ammophila) *sickmanni sickmanni* Kohl, 1901  
 - Mesopleuron rather sparsely punctured, pile on lower frons and clypeus golden, covering pile on thorax-complex much closer and more distinct. Formosa  
 (Ammophila) *sickmanni wusheensis* subsp. nov.
- 20 Clypeus with anterior margin very gently emarginate (supra-antennal lamellate projections well developed and high, thorax-complex except dorsum of propodeum thinly covered with short silvery pubescence, silvery pile patch of mesopleuron broad but not dense, not well outlined, usually the greater part of tergite 1, the following segment wholly and the basal portion of the next following segment, with the exception of dorsal streak, red), length 19-22 mm. Formosa  
 (Ammophila) *formosana* sp. nov.  
 - Clypeus with anterior margin fairly deeply emarginate  
 (Ammophila) *sabulosa* Linné ..... 21
- 21 Supra-antennal lamellate projections less developed, sometimes vestigial (pile patch on mesopleuron large but not dense, not well-outlined, collar of pronotum shorter, with anterior aspect more gently inclined, than in *infesta*, mesonotum partly punctate-rugose, 3rd tergite



and sternite at base frequently red), length mostly 18-22 mm. Europe, N. Africa and Siberia, having vertical distribution up to 2200 m on the Alps

(*Ammophila*) *subulosa sabulosa* (Linné, 1758)

— Supra-antennal lamellate projections well developed and high, silvery pile patch of mesopleuron varied in development, but generally somewhat less distinct, disc of pronotum more developed, most usually with anterior margin vertical or nearly ..... 22

22 Punctures on mesonotum and mesopleuron comparatively sparser, generally less rugosely punctate, silvery pile patch on mesopleuron much less distinct in general, usually the montane dweller in Japan, occurring also in Korea

(*Ammophila*) *sabulosa infesta* Smith, 1873

— Punctures on mesonotum and mesopleuron comparatively closer, more broadly rugosopunctate or punctate-striate, silvery pile patch on mesopleuron much more distinct, but not well outlined, usually lowland dweller in Japan, living also in Korea

(*Ammophila*) *sabulosa nipponica* subsp. nov.

## 2. Notes on the red-legged *Ammophila* in eastern Asia and Australia

There have been described three species of *Ammophila* the females of which have the red legs from South and East Asia and Australia, namely *Ammophila atripes* Smith, 1856, from India, *Ammophila clavus* (Fabricius, 1775) from Australia and *Ammophila japonica* Kohl, 1906 from Japan. The related references:

*Sphex clavus* Fabricius, Syst. Ent., p. 348, 1775.

*Ammophila atripes* Smith, Ann. Mag. Nat. Hist. (2) 9: 46, 1852; Cat. Hym. Ins. Brit. Mus., 4: 217, 1856.

*Ammophila atripes*: Bingham, Faun. Brit. Ind., Hym., 1: 229, 1897 (with synonyms of *similima* Smith, 1856; *pulchella* Smith, 1856; *spinosa* Smith, 1873; *buddha* Cameron, 1889; *longiventris* Saussure (?) and references by Smith, 1856 and Cameron, 1889).

*Ammophila japonica* Kohl, Ann. k. k. Nat. Hist. Hofmus. Wien, 21: 328, 1906 (with a synonym list).

*Ammophila clavus*: Turner, Proc. Zool. Soc. Lond., 30: 463, 1908.

*Ammophila basalis*: Matsumura, Thous. Ins. Jap., Suppl. 3: 119, 1911.

*Ammophila atripes*: Strand, Arch. Naturg. Abt. A, 1913 (3): 85, 1913.

*Ammophila clavus*: Maidl, Ent. Mitt., 14 (5, 6): 381, 1925.

*Ammophila clavus*: Sonan, Trans. Nat. Hist. Soc. Formosa, 17 (89): 132, 1927 (biol.).

*Ammophila atripes*: Matsumura et Uchida, Thous. Ins. Jap., Ed. 2, Hym., p. 20, 1930.

*Ammophila basalis*: Matsumura, 6000 Ill. Ins. Jap. (Tokyo), p. 17, 1931.

*Ammophila japonica*: Yano, Icon. Ins. Jap., Ed. 1: 284, 1932.

*Ammophila clavus*: Yasumatsu, Ins. Jehol (7), Hym., 2: 22, 1935.

*Ammophila clavus*: Tsuneki, Jap. Hunt. Wasp., p. 53, 1946 (biol.).

*Ammophila clavus*: Yasumatsu, Icon. Ins. Jap., Ed. 2: 1473, 1950.

*Ammophila clavus*: Van der Vecht, Zool. Verhandl., 48: 39, 1961.

*Ammophila clavus*: Tsuneki, Life Study (Fukui), 6 (2): 25, 26, 1962.

*Ammophila atripes*: Tsureki, Ins. Mats., 26 (2): 101, 1963.

*Ammophila clavus*: Yasumatsu, Icon. Ins. Jap. Col. Nat., 3: 299, 1965.

*Ammophila clavus*: Tsuneki, Kontyu, 35 (4): 383, 1967.

As for the affinity between *A. clavus* (F.) and *A. atripes* Sm. four entomologists have published their opinion basing on the direct comparison of the specimens:

F. F. Kohl in connection with *Ammophila japonica* says that wahrscheinlich ist diese grosse *Ammophila* des japanischen Insellandes nur eine in das paläarktische Gebiet hineinragende Abänderung der orientalischen *A. atripes* Smith, die möglicherweise selbst wieder nur eine Varietät der *A. clavus* Fabr. der australischen Region ist. Die Unterschiede zwischen diesen Arten sind nur relativ geringe (1906, S. 328). As for *Amm. clavus* he says on the first page of his



Table 1. Body length (mm), relative length of petioles 1 and 2 (7.7 corresponds to 1 mm) of *Ammophila clavus* (Fabr.) of various localities.

♀					♂				
Locality	Body length	Petiole 1	Petiole 2	Ratio 1:2	Locality	Body length	Petiole 1	Petiole 2	Ratio 1:2
Malaya	20.2	33.5	28.0	1.20					
Hengchun	24.0	34.0	31.0	1.10	Hengchun	17.0	29.0	27.0	1.07
Manchou	20.0	24.0	24.0	1.00	Hengchun	18.0	33.0	30.0	1.10
Chihpenchi	23.0	32.0	28.0	1.14	Manchou	18.0	32.0	28.0	1.14
Kuantsuling	25.5	35.0	32.0	1.09	Manchou	19.0	34.0	30.0	1.13
Chuchi	24.0	33.0	31.0	1.06	Chihpen	23.0	38.0	33.0	1.15
Chuchi	24.0	32.0	31.0	1.03	Taoyeh	15.0	26.0	22.0	1.18
Chuchi	24.0	32.0	31.0	1.03	Chulu	24.0	40.0	35.0	1.14
Chuchi	25.0	37.0	33.0	1.12	Chulu	22.0	37.0	33.0	1.12
Lihyuehtan	19.0	28.0	26.0	1.08	Kuantsuling	22.0	38.0	35.0	1.09
Lihyuehtan	28.0	39.0	37.0	1.05	Liyuchih	25.0	40.0	37.0	1.08
Puli	24.0	35.0	32.0	1.09	Lihyuehtan	18.0	34.0	30.0	1.13
Puli	23.0	33.0	31.0	1.06	Lihyuehtan	19.0	35.0	32.0	1.09
Puli	24.0	35.0	32.0	1.09	Puli	20.0	34.0	30.0	1.13
Puli	24.0	33.0	30.0	1.10	Puli	22.0	37.0	32.0	1.16
Puli	24.0	33.0	32.0	1.03	Puli	18.0	32.0	29.0	1.10
Puli	23.0	33.0	30.0	1.10	Puli	24.0	40.0	37.0	1.08
Penpuchi	24.0	35.0	32.0	1.09	Penpuchi	21.0	37.0	33.0	1.12
Tsukeng	23.0	33.0	29.0	1.14	Penpuchi	22.0	37.0	32.0	1.16
Tsukeng	22.0	30.0	28.0	1.07	Tsukeng	20.0	36.0	32.0	1.13
Ilan	23.0	32.0	30.0	1.07	Tsukeng	20.0	35.0	31.0	1.13
Taipei	24.0	34.0	30.0	1.13	Tsukeng	25.0	40.0	35.0	1.14
Ishigaki	24.5	35.0	33.0	1.06	Ishigaki	24.5	41.0	37.0	1.11
Ishigaki	23.5	34.5	32.0	1.08	Ishigaki	22.5	36.0	33.0	1.09
Ishigaki	21.5	32.0	28.0	1.14	Ishigaki	19.5	34.0	30.0	1.13
Ishigaki	24.0	34.0	30.5	1.11	Miyako	17.0	29.0	26.0	1.11
Ishigaki	24.3	34.0	30.0	1.13					
Ishigaki	23.5	34.0	32.0	1.06					
Ishigaki	21.5	32.0	30.0	1.07					
Ishigaki	24.0	35.0	32.0	1.09					
Miyako	22.5	32.0	30.0	1.07					
Hyogo	29.0	38.0	35.0	1.09	Saitama	31.0	49.0	46.0	1.07
Hyogo	26.0	34.0	33.0	1.03	Akita	25.0	41.0	38.0	1.08
Hyogo	28.0	35.0	35.0	1.00	Akita	23.0	34.0	32.0	1.06
Hyogo	33.5	42.0	42.0	1.00	Akita	27.0	42.0	40.0	1.05
Fukui	31.0	41.0	40.0	1.03					
Saitama	33.0	41.0	40.0	1.03					
Saitama	30.0	39.0	39.0	1.00					
Saitama	32.0	40.0	39.0	1.03					
Saitama	34.0	42.0	40.0	1.05					
Saitama	32.0	41.0	38.0	1.09					
Akita	30.0	38.0	37.0	1.03					
Akita	32.0	40.0	39.0	1.03					
M. Korea	34.0	46.0	44.0	1.05	M. Korea	29.5	47.0	44.0	1.07
					M. Korea	29.0	47.0	43.0	1.09
					M. Korea	28.5	45.0	43.0	1.05
					M. Korea	28.0	48.0	45.0	1.07
					M. Korea	25.5	43.0	36.0	1.10
Average					Formosa	20.5	35.2	30.1	1.12
Formosa	23.5	33.0	30.5	1.08	Ryukyu	20.6	34.8	31.4	1.11
Ryukyu	23.3	33.6	30.8	1.09	Japan	26.5	41.5	39.0	1.06
Japan	30.9	39.3	38.1	1.03	Japan	26.5	41.5	39.0	1.06
* Korea	34.0	46.0	44.0	1.05	Korea	28.1	46.0	42.8	1.07

monograph "... , namentlich bieten die Arten aus der Gruppe der *Amm. clavus* Fabr. nicht unbedeutende Schwierigkeiten. Darum hielt ich es für geboten, die Veröffentlichung des zweiten Teiles der Ammophilinen auf eine spätere Zeit zu verschieben" (Ibid., S. 228). But he did not publish the result of his detailed comparison between the two species in question after all.

F. Maidl (1925) dealt with *A. atripes* as a synonym of *A. clavus*. His opinion was, however,

based on the specimens of the Oriental and Australian Region that were identified by Kohl as *A. clavus*.

On the other hand, J. Van der Vecht (1961) separated the two species as distinct. He pointed out that in *A. clavus* the fringe of long erect hairs on the temples is much more distinct than in *A. atripes*.

I myself in a paper dealing with the Malayan Hymenoptera admitted the character mentioned by Van der Vecht on a specimen from Parit Buntar and concluded that if followed his opinion the Japanese and the Korean representatives must be included within the range of *A. clavus*, though I threw some doubt as to whether or not such a difference was sufficient enough to separate the species.

As to the difference between the red legged *Ammophila*-species of Japan and Formosa E. Strand (1913, p. 85) attempted the comparison of the Formosan specimens with the original description and figure of *A. japonica*. He admitted the difference in the body size and accepted the separation of the two populations at the specific level. He further alluded to the wing venation (the form of the cubital cells) and facial convergency and mentioned that the latter character is apparently stronger in the Formosan specimens.

Now, I have an ample material of Formosan as well as the Japanese representatives. My regret is the lack of the Indian and the Australian specimens except the single female from Malaya. But this specimen presented a remarkable character which exerted a profound influence upon my opinion though with some uncertainty.

I took notice of the fact that in the Malayan specimen petiole 1 (sternite 1) is distinctly longer than petiole 2 (tergite 1), while in the Formosan and the Japanese examples they are approximately equal in length. Measurement clearly showed the fact (Table 1). I further reconfirmed that the hair-bearing punctures on the temples are much sparser in the Malayan specimen, with the fringe of long erect hairs is much less distinct accordingly, as pointed out by Van der Vecht.

It is regretted that the specimen is only a single, but if it represents the normal characters of *A. atripes* it must certainly be a note-worthy distinction. On the other hand, judging from the fact that such a difference was not pointed out between *clavus* and *atripes* by any previous investigator it seems probable that the same is true with *A. clavus* from Australia and its adjacent regions. If so the specimens from Formosa and the southern Ryukyus must forms a separate population.

Between the populations of Formosa-Ryukyus and Japan-Korea there is no difference at all regarding the two characters mentioned. But they are markedly different in the body size as was designated by Kohl and Strand.

According to the literature the Formosan specimens differ from the Australian specimens, apart from the character of the abdominal petiole, somewhat in colour. Turner (1908) described that the Australian *Ammophila clavus* has the basal three joints of antennae and the trochanters of the legs red. In the Formosan specimens antennal joints 2 and 3, and all the trochanters of the legs always black. J. Van der Vecht in his 1961 paper described that in most of the females of a series of *A. clavus* from Queensland in the British Museum . . . . the third gastral segment varies from black to almost entirely red. Such a colour change is not met with in the Formosan and the Ryukyu specimens.

Basing upon the considerations, observations and references above mentioned I arrived at the following conclusion:

A. The population of South and Southeast Asiatic Continent:

*Ammophila (Ammophila) clavus atripes* Smith, 1852 (eastern range uncertain).

B. The Australian population:

*Ammophila (Ammophila) clavus clavus* (Fabricius, 1775) (western and northern range uncertain).

C. The population of Formosa and the Ryukyus:

*Ammophila (Ammophila) clavus taiwana* subsp. nov.

Holotype: ♀, Puli, 8. VII. 1965; Paratypes: 21 ♀♀ 21 ♂♂ given in Table 1, leg. K. Tsuneki.

D. The population of Japan, Korea and South Manchuria:

*Ammophila (Ammophila) clavus japonica* Kohl, 1896.

*The Formosan specimens examined*: 33 ♀♀ 65 ♂♂:

4 ♀♀ 5 ♂♂, Taipei Pref. (4 ♀♀ 4 ♂♂, Yangmingshan, 3. VII, 24. VIII.; 1 ♂, Ulai, 6. VII.); 1 ♂, Taoyuan Pref. (Yangmei, 5. VII.); 3 ♀♀ 7 ♂♂, Ilan Pref. (Tsukeng, 19. VIII.); 1 ♀ 2 ♂♂, Hualien Pref. (1 ♂, Liyuchih, 16. VIII.; 1 ♀ 1 ♂, Tien-Hsiang, 17. VIII.); 14 ♀♀ 24 ♂♂, Nantou Pref. (11 ♀♀ 14 ♂♂, Puli, 8-14. VII.; 1 ♀ 4 ♂♂, Penpuchi, 30. VIII.; 2 ♀♀ 6 ♂♂, Lihyuehtan, 24. VIII.); 2 ♀♀ 11 ♂♂, Taitung Pref. (1 ♀ 6 ♂♂, Chihpenchi, 13. VIII.; 2 ♂♂, Chulu, 12. VIII.; 3 ♂♂, Taoyeh, 14. VIII.; 1 ♀, Taitung, 11. VIII.); 3 ♀♀ 3 ♂♂, Chiayi Pref. (Chuchi, 21. VII.); 1 ♀ 2 ♂♂, Tainan Pref. (Kuantsuling, 19. VII.); 5 ♀♀ 10 ♂♂, Pingtung Pref. (2 ♂♂, Manchou, 4. VIII.; 1 ♀, Ssuchungchi, 6. VIII.; 4 ♀♀ 8 ♂♂, Hengchun, 2-8. VIII.).

*The Ryukyu specimens examined*:

1 ♀ 1 ♂, Miyako Is., XI-XII. 1952; 8 ♀♀ 3 ♂♂, Ishigaki Is. (VII, VIII, XI, 1952, 63.). As to the Japanese and Korean specimens see Table 1.

### 3. On *Ammophila* of *sickmanni* group

During the examination of the Korean specimens of *Ammophila* in connection with the problem concerning the eastern representatives of *Ammophila sabulosa* I happened to find some specimens of a strange species. Literature indicated that it is nothing else than *Ammophila sickmanni* Kohl, described from North China. To my surprise, among the Formosan material were found some specimens that were closely related to it. Detailed comparative study led me to the conclusion that they represent another subspecies of *sickmanni*. In the following the descriptions on these specimens will be given.

#### *Ammophila (Ammophila) sickmanni* Kohl, 1901

*Ammophila* sp. Sickmann, Zool. Jahrb. Syst., 8 (2): 216, 1895.

*Ammophila sickmanni* Kohl, Ann. k. k. Naturh. Hofmus. Wien, 16: 151 (♀), 1901.

*Ammophila sickmanni*: Kohl, Ibid., 21: 340, 1906.

This species (♀) is characteristic in having the abdomen black in colour without the steel blue lustre, the mesonotum very strongly transversely striate, the propodeum without the median carina and silvery pile patches on humeral angle, mesopleuron and propodeum above the hind coxa quite marked. The male, however, remains undescribed. It was found among the Korean specimens:

♂. Length 17-19 mm. Similar to ♀ in colour except the presence of the incomplete narrow black streak on tergites 1, 2 and 3. Thorax-complex except the dorsal aspect of propodeum fairly closely covered with short brassy pile which is particularly dense at the given areas of the pile

patches and closer and larger than in ♀; pile on frons and clypeus also brassy. IOD at the anterior ocellus as great in length as antennal joints 2+3+4, and at clypeus approximately as joints 2+3, the ratio between the two 5 : 3; clypeus (Fig. 1) gently roundly convex and produced anteriorly, with apical margin approximately as wide as lateral margin of the produced area and distinctly roundly emarginate. Characteristic of the species is that the disc of clypeus inclined at its medio-apical area into the glabrous and polished bevel. Pronotum well developed, nearly half as long as wide, dorsal aspect longitudinally rounded and anterior aspect nearly perpendicular, sometimes somewhat shorter and somewhat more gently inclined anteriorly. Petiole 1 longer than petiole 2, combined together approximately as long as hind tibia, but in some specimens shorter, tergite 2 twice as long as broad at apex.

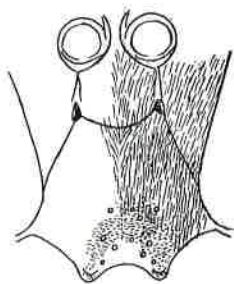


Fig. 1 *Ammophila sickmanni* Kohl, ♂. Clypeus and supra-clypeal area

Vertex sparsely punctured with medium-sized punctures, pronotum similarly punctured and on anterior aspect in part finely and closely striate, in some specimens the area rather coarsely rugose or punctate-rugose in addition, even on the dorsal aspect. Mesonotum transversely coarsely rugoso-striate, with finer striae and sparse punctures between, on posterior portion the striae turning arcuate; mesopleuron closely rugoso-punctate. Propodeum with area cordata distinctly outlined and broadly rugoso-reticulate, without distinct median carina, only on lateral portions obliquely striate.

*Specimens examined*: 1 ♀, Saishu Is. (Cheju Do), Mt. Doho, 5. VIII. 1958, C. W. Kim leg.; 1 ♂, Keijo (Seoul) 14. VI. 1941, K. Tsuneki leg.; 1 ♂, Seoul (Hokkan-zan), 28. VIII. 1956, C. W. Kim leg.; 1 ♂, Mt. Kaya, 5. VIII. 1960, C. W. Kim leg.

*Remarks*. Some of the specimens show fairly marked variation in the form and sculpture of the pronotum, but the characters of this segment are frequently varied within a species.

The female differs from the original description in that the inner orbits not completely parallel, but slightly convergent toward the clypeus.

#### *Ammophila (Ammophila) sickmanni wusheensis* subsp. nov.

The new subspecies from Formosa differs from the typical race in the following points:

♀. (1) Lower frons and clypeus covered with short silvery pile as in *A. modesta* Mocsáry, covering not dense but fairly close, in the worn-out specimens largely rubbed off, especially on clypeus.

(2) Sculpture on pro- and mesonotum weaker.

(3) Punctures on mesopleuron sparser, less rugosely confluent.

♂. (1) Punctures on mesopleuron much sparser, not rugosely confluent.

(2) Brassy pile covering thorax-complex closer and more distinct.

But the genital structure quite similar.

The male genital organs resemble those of *sabulosa*-group, differing from it, however, in that generally the structure more delicate and paler in colour, apical swelling of penis valve shorter, apical hook-shaped triangular appendage somewhat slenderer and the paramere with the inner medial angle much more angulated.

#### *Some supplementary description*:

Clypeus (♀) with medial produced area narrower than in Fig. 2. IOD at anterior ocellus (♀) = antennal joints 2+3+half of 4, or = 3+3/4 of 4; at clypeus (♂) = 2+3. Petiole 1 (♀) about as long as hind tarsal joints 1+2, (♂) 1+2+half of 3. Red of abdomen: (♀) Petiole 2 except base, the following segment wholly, basal half of the next following; (♂) petiole 2



largely and the 2 following segments, but all these with dorsal streak black.

Holotype: ♀, Nantou Pref. (Chienching), 9. VII. 1965, K. Tsuneki leg.

Paratypes: 1 ♀, the same as above; 3 ♂♂, Meichi, 12. VII. 1965, K. Tsuneki leg.

#### 4. Notes on *Ammophila subassimilis* Strand, 1913

*Ammophila subassimilis* Strand, Arch. Naturg. Abt. A, 1913 (3): 86, 1913.

The original description: Petiolus zweigliedrig. Pronotum mit Andeutung von Querstrichelung, das Mediansegment undeutlich quer gestrichelt und ohne Längskiel. Klauen unbewehrt. *Innenränder der Augen gegen den Kopfschild schwach konvergent*. Stigmen des ersten Tergits beträchtlich hinter der Mitte der nur unbedeutend erweiterten Dorsalplatte. — Durch Kohls Bestimmungstabellen der paläarktischen Ammophilen kommt man auf *A. assimilis* Kohl, aber das ♀ hat an den Mesopleuren einen (blass messing-glänzenden) Tomentfleck und *die inneren Orbitae sind an der vorderen Ocelle um weniger als die Länge des I.+II.+III. Geißelgliedes unter sich entfernt*, beim ♂ ist das erst Glied des Petiolus ein wenig länger als das zweite und so lang wie Metatarsus + die beiden folgenden Tarsenglieder des 4. (? 3.) Beinpaares. Dorsulum ist ganz matt (beim ♀ schwach glänzend). Auch beim ♀ sind die Thoraxseiten nicht oder nur ganz schwach glänzend, deutlicher aber die Rückenseite. Das erste Stielglied des ♀ ist so lang wie Metatarsus + das ganz folgende Tarsenglied des hinteren Beinpaares. Die Rückenplatte des dritten Hinterleibsringes ist beim ♀ kaum um 1/3 länger als am Endrande breit, beim ♂ wie bei *assimilis* reichlich doppelt so lang wie am Endrande breit. *Beim ♂ ist der ganze Thorax mehr oder weniger dicht mit messing-gelber Pubeszenz oder Toment bekleidet*, das sich an den Mesopleuren zu je einem ellipsenförmigen Schrägfleck verdichtet; einen ebensolchen kleineren Tomentfleck trägt der Stutz beiderseits der Einlenkung des Petiolus. Die Körperlänge dürfte um 1-2 mm geringer also bei *assimilis* sein. — Wo das Gegenteil nicht angegeben ist, stimmt die Beschreibung von *assimilis* Kohl mit vorliegender Form, die vielleicht am besten als eine Lokalvarietät aufzufassen wäre.

As above cited the original description of *Ammophila subassimilis* Strand (1913) agrees in many characters with *Ammophila sickmanni wusheensis*, but according to "Wo das Gegenteil nicht angegeben ist, stimmt die Beschreibung von *assimilis* Kohl mit vorliegender Form" it differs from that subspecies at least in the following two points:

(1) Supra-antennal lamellate projections are not developed (♀♂).

If Strand actually followed the Kohl's key he must have examined this character just before he reached *assimilis*, at least in ♀.

(2) Lower frons and clypeus are not covered with silvery pile (♀).

This character is also appeared in the Kohl's key at the time of separation of *assimilis* from *modesta*. Therefore, Strand must have examined this character also.

Despite the fact above mentioned I feel that the differences might be overlooked and *Ammophila subassimilis* may be identical with *Ammophila sickmanni wusheensis*. But the actual differences supported by the above described reasons make me hesitate to identify the specimens of *A. s. wusheensis* with *subassimilis*. If the future examination of the type confirms the identity of the two species the subspecific name of *wusheensis* must be replaced with *subassimilis*.

Sonan (1942) dealt with *Ammophila subassimilis* as a synonym of *Ammophila infest* Smith which he also identified with *Ammophila vagabunda* Smith. Apart from the last mentioned identification., *Ammophila subassimilis* differs at least from *Ammophila infesta* Smith in the following points:



It lacks the steel blue lustre on the posterior black portion of the abdomen. It lacks the median carina on the dorsum of the propodeum, and presumably also the supra-antennal lamellate projections on the frons. On the other hand, it possesses well developed 3 silvery pile patches on the sides of the thorax-complex. Further, it also differs from *infesta* (s. str.) in the punctuation and sculpture of the thorax-complex.

##### 5. *Ammophila formosana* sp. nov.

? *Ammophila vagabunda*: Sonan (nec Smith), Trans. Nat. Hist. Soc. Formosa, 32 (222): 132, 1942.

? *Ammophila infesta*: Sonan (nec Smith), Ibid., p. 132, 1942.

*Ammophila subassimilis*: Tsuneki (nec Strand), Kontyu, 35 (4): 383, 1967.

This species is characteristic in having the lower frons and clypeus covered with silvery pile (♀) and the anterior margin of the clypeus only very shallowly emarginate (♂).

According to the Kohl's key the female easily reaches the group of *sabulosa* — *infesta* without touching the character of the silvery pubescence on the lower frons and clypeus. It differs however, from *sabulosa* in the presence of the well-developed supra-antennal projections and from *infesta* in possessing the well marked pile patch on the mesopleuron. But the difference in the pilosity of the frons and clypeus is considered more important.

If the metallic blue shine of the apical black portion of the abdomen and the supra-antennal lamellae are neglected it runs in the Kohl's key to *Ammophila modesta* Mocsáry, with the consideration of the above mentioned pile on the anterior aspect of the head.

In the key, the male also goes straight to *sabulosa* — *infesta* group, and if the metallic blue shimmer of the abdomen is disregarded it goes to the group of *modesta-assimilis*.

The present species differs, however, from the *sabulosa* group, in addition to the characters referred to above, by that the petiole, especially 1, distinctly longer (♀♂), the red portion of the abdomen more widely extended (♀♂) and the medio-anterior margin of the clypeus more shallowly emarginate (♂).

From *Ammophila modesta* it differs, besides the characters above described, in that the body is larger (♀♂), the extension of the red on the abdomen is narrower (♀♂), IOD at anterior ocellus (♀) relatively shorter (in *modesta* the IOD equal to antennal joints 2+3+4, in this 2+3+half of 4), IOD at clypeus (♂) relatively shorter (in *modesta* 2+half of 3, in this equal to 3), petiole 1 much longer (♀♂) (in ♀, in *modesta* equal to hind tarsal joints 1+half of 2, in this 1+2+half of 3; in ♂, in *modesta*=1+2, in this 1+2+3). Further, the punctuation on mesonotum and the sculpture on propodeum also more or less different.

This species is apparently much closer to *Ammophila sickmanni wusheensis* just previously described. But the close examination shows the following differences from it:

(1) ♀♂. Apical black of the abdomen with a blue glancy; propodeum on dorsal aspect with a distinct medial carina; rugose-striae on mesonotum generally much weaker; petiole 1 of abdomen relatively shorter; cubital cell 2 comparatively shorter and higher.

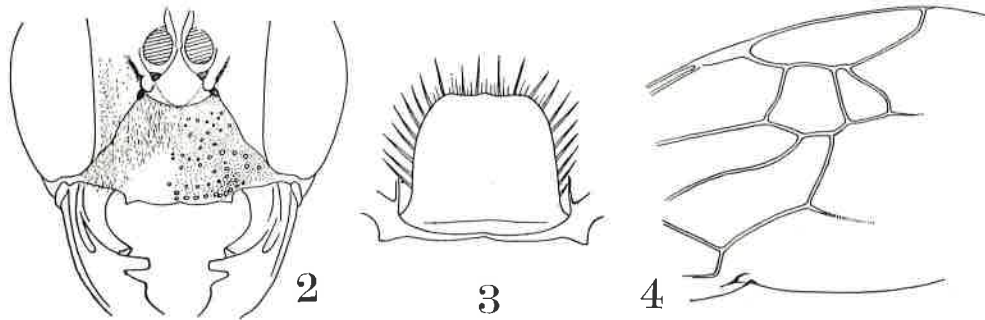
(2) ♀. Medio-anterior margin of clypeus relatively wider as compared with the lateral margin; IOD at anterior ocellus relatively shorter.

(3) ♂. Thorax without short close brassy pile covering; clypeus without bevel at the anterior margin in middle; genitalia more robust, with paramere having the inner-medial angle less angulated.

♀. Length 18-20 mm. Black; 1st sternite at apex, 1st tergite except base, 2nd and 3rd tergites and sternites wholly yellowish red; anterior margin of clypeus narrowly and wing tegulae

in part semitransparent brown. Wings pale brown, apical margin broadly darkened. Sides of lower frons and clypeus fairly closely covered with short appressed silvery pubescence, similar but much shorter and less conspicuous pubescence defined on mesonotum, mesopleuron, sides of propodeum and coxae of legs; in addition body sparsely covered with long greyish-white pubescence, also a few longer stiff brownish hairs beneath clypeus and mandibles. Silvery pile patches on humeral angle, mesopleuron and posterior aspect of propodeum just above hind coxa well developed and large as in *A. sabulosa*. The glittering grade of vertex and mesonotum markedly varied with the state of covering short pubescence; when rubbed off both quite glossy.

Head in front with inner orbits parallel, clypeus and supra-clypeal area: Fig. 2, supra-antennal lamellate projections high, disc of clypeus gently convex, labrum: Fig. 3; relative length of antennal joints 3, 4 and 5: 35, 22 and 20. Head from above with IOD at anterior ocellus  $\cong$  antennal joints 3+4, OOD : POD  $\cong$  2 : 1 (17 : 7), ocellar region enclosed by a fine groove as usual. Pronotum formed as in *A. sabulosa*, mesonotum with anterior medial broad furrow and posterior lateral broad furrows present, more or less varied in strength of impression, the median furrow covers about 5/6 of the segment, general feature similar to that of *sabulosa*; scutellum either feebly impressed in middle, or entire, mesopleuron with episternal suture present, propodeum with area cordata distinctly margined and medially carinated. Petiole 1 (sternite 1) as long as hind tarsal joints 1+2+half of 3, and as long as petiole 2 (tergite 1) or slightly longer, stigmata located about 1/3 from apex, tergite 2 longer than wide at apex (65 : 50); fore wing venation: Fig. 4; spines of legs as in *sabulosa*, but generally less strong



Figs. 2-4. *Ammophila formosana* sp. nov., ♀.

2, Clypeus and supra-clypeal area. 3, Labrum, seen from beneath. 4, Venation of fore wing.

Vertex very sparsely, upper frons and clypeus moderately sparsely punctured with medium-sized points, with intervals microscopically coriaceous, less glossy, pro- and mesonotum more glossy when the fine pubescence denuded off; pronotum on anterior inclination transversely coarsely rugoso-striate, intervals filled with numerous very fine striae, disc sparsely punctured with medium-sized points, the points partly transversely confluent; mesonotum coarsely punctate-striate, the striae weaker, or lacking and simply punctured, on median area, much more distinct on antero-lateral areas and finely closely and somewhat obliquely running on lateral furrows (the sculpture more or less varied in strength and in grade of striation with the specimens), scutellum longitudinally, postscutellum obliquely striate; mesopleuron transversely closely punctate-striate, metapleuron obliquely (nearly longitudinally) closely rugoso-striate; propodeum on area cordata obliquely closely striate, sometimes the striae on medial region more rugose, sides of the segment obliquely coarsely rugoso-striate and on intervals of the coarse striae finely striate and sparsely punctured; posterior inclination rugoso-striate.

♂. 16-20 mm. Similar to ♀. Red of abdomen: tergite 1 except base, tergite and sternite 2 wholly, and 3 at base, all these tergites carrying black streak, all not completely filling whole the length. IOD at clypeus nearly equal to antennal joint 3, OOD : POD = 16 : 9. Petiole 1 usually slightly longer than 2, sometimes almost equal, as long as hind tarsal joints 1+2+3, or 1+2+half of 3. Greyish white hairs on body more abundant and pile patch on mesopleuron similar in extension, but less dense, not distinctly outlined and less conspicuous.

Holotype: ♀, Chiayi Pref. (Fenchihu), 24. VII. 1966, K. Tsuneki leg.

Paratypes: 1 ♀ 3 ♂♂, the same as holotype; 1 ♀ 2 ♂♂, Chiayi Pref. (Shitsulu), 29. VII. 1966, 2 ♂♂, Nantou Pref. (Chienching), 9. VII. 1966, K. Tsuneki leg; 2 ♂♂, Nantou Pref. (Wushe — Chienching, Sungkang, 7, 17. V. 1965, T. Shirozuleg.

#### 6. Notes on *Ammophila sabulosa infesta* Smith and a related subspecies

In the black-legged *Ammophila* having the two jointed petiole and the metallic blue shine on the abdomen occurring commonly in Japan and Korea a wide range of variation is observed and some of which are very close to *A. sabulosa* Linné of the western Palaearctic region, obliterating the greater part of the differences that were formerly pointed out by Kohl (1906) as existing between the two species, remaining only a few that are also no more than the slight differences in degree. Basing upon such a fact I determined to deal with *infesta* Smith as a geographical race of *sabulosa* Linné.

Having recently reexamined about 60 specimens at hand it became to be guessed that the variation among specimens of *A. infesta* was not of the fluctuative, nor of the seasonal one, but was apparently in close connection with the height of the localities they derive, that is to say, the form that was dealt with by Smith as the type of *A. infesta* and that was later redescribed and compared with the European *sabulosa* by Kohl represented the montane form, while that was particularly treated by me was the representative of the lowland and hill form.

In order to confirm the relationship between the two forms I collected the specimens of the *Ammophila* from various localities of Japan with the help of my colleagues. As a result I could examine about 500 specimens newly collected including about 350 individuals collected by myself of which the detailed localities and heights were recorded. First I will give the characters of the typical two forms in Table 2.

Among the characters listed in the Table the most easily observed is the sculpture of the mesonotum. As to the character, however, there are more or less variations among the specimens of both forms. We can find some intermediate specimens among the montane representatives which somewhat approach in the character to the lowland form and some intermediate ones among the lowland members which are somewhat inclined in the character to the montanic form. But such specimens in the male, in the case of a group of more than 10 from the same locality, cannot surpass 20 % in the montane inhabitants (average 10.7 %) and 12 % in the lowland representatives (average 10 %), and in the female none in the montanic form and only 5.1 % in the lowland dwellers (average 3.8 %).

The sculpture on the mesopleuron seems more fixed than on the mesoscutum, including the intermediate in the male 6 % in the maximum in the montane form and less than 2 % (maximum) in the lowland form, and in the female none in both forms.

Most of such intermediate forms were collected in the regions close to the bordering zone of both the forms, but rarely there are a few such specimens in the lowland as well as the highland areas. However, we can never find the typical lowland form among the specimens having the

Table 2. Differences in characters of the montanic and lowland forms of *A. sabulosa* in Asia

Characters	Montane form ( <i>sabulosa infesta</i> )	Lowland and hill form (s. <i>nipponica</i> )
Body size	♀ ♂ { On an average larger than the lowland form	{ On an average smaller than the highland form
Sculpture on mesonotum	♀ { Punctures fine and very sparse, almost without striae, rugae or punctured-rugae	{ Punctures larger, closer, indistinct in outline, confluent into transverse or oblique punctured-rugae
	♂ { With more or less weak punctured-rugae, but they are confined to the posterior portion alone, punctures small and scattered	
Sculpture on mesopleuron	♀ { Punctures slightly closer than on mesonotum, but finer, sparser than in lowland form, especially so on the anterior portion; each puncture distinctly separated	{ Punctures larger, closer, confluent into transverse puncture-lines or punctured-rugae, distinct on anterior portion
	♂ { Punctures with posterior outline indistinct, closer than in ♀, but each distinctly separated, not forming puncture-lines	
Toment on mesopleuron	♀ { As a rule absent, at most with a few vestigial silvery hairs	{ In the majority present, especially in fresh specimens, sometimes as large and as distinct as in <i>sabulosa</i> s. str.
	♂ { Silver pile sparse, not distinctly outlined, not forming toment	
Toment on tubercle & propodeum	♀ { Tubercle: Posterior margin silvery, the rest yellowish. Supra-hindcoxal area: Smaller than in lowland form	{ Tubercle: Wholly covered with silvery pile, distinct. Supra-hindcoxal area: Larger than in the montane form
Pronotum in lateral view	♀ ♂ { Almost semicircular, anterior inclination nearly vertical, sometimes with top of curvature behind middle	{ More frequently with top of curvature behind middle as in <i>sabulosa</i> s. str., with anterior inclination oblique
Black streak on tergite 2 of abdomen	♂ { Always thick and distinct, as a rule running over the full length of segment	{ Very frequently weak, narrow and shorter
Apical lobe of paramere	♂ { Flat, elongated lobiform, distinctly broader than in lowland form	{ Form similar, but the lobe clearly narrower, without difference from that of <i>sabulosa</i> s. str.

reliable data of the highland and the typical highland form among the doubtless lowland representatives.

As above mentioned these intermediate forms appear largely in the male, but when based on the structure of the male genital organs (the form of the paramere) most of such doubtful forms can clearly be separated into the two forms dealt with here. Out of 15 apparently intermediate specimens I could find only two which were really intermediate in the characters of the parameres.

Though very few in number the existence of such specimens is quite significant in regard to the affinity of the two forms and at the same time the very few in number of such specimens is considered to be a proof of the high stability of the two forms.

Based on the 343 specimens collected in Fukui Prefecture which are known in more detail in regard to the height and contour of the localities it can roughly be said that the montane form lives above 300 m in height and the lowland and hill form is the inhabitant of the area below 200 m.

The path below the Arashi village which supplied a comparatively large number of the near-intermediate form of the montanic type is located at about 300-400 m, thus near the intermediate zone of the habitats of both the forms.



On the other hand, the distribution of the two forms is not always ruled by the height of the area alone. In the closed valley-formed area located comparatively low above the sea-level (but to a certain extent) occurs usually the montanic form and, to the contrary, in the open basin located comparatively high level lives the lowland form. The sparsely vegetated bed of the river Mana in the midst of the Ohno-basin, about 200 m in height, is lived abundantly by the typical lowland form, while in a village, Iwaya, along a small tributary downstream, only 175 m above the level of the sea, furnishes us with the typical montanic form alone. The hills (160-230 m) scattered over the Etizen plain are all inhabited by the lowland form, while the population on the upper portion of Mt. Monju, lying from about 250 to 360 m, belongs to the montane form. This mount is connected by a range of hilly ridge with the eastern high mountain range of the Prefecture. It seems worthy of notice that in a isolated or semi-isolated mount having the montanic form on the upper portion is surrounded with a vacant non-inhabited zone of the *Ammophila* on the lower — foot regions. This is certainly the case with Mt. Aoba (700 m), Mt. Hino (800 m) and Mt. Monju (360 m) as far as observed by me.

I have 50 specimens (22 ♀♀ 28 ♂♂) of both forms mentioned of *Ammophila* collected in Korea, but as these have no record of height some of them can not be the material for my present study. However, some others which were derived from the localities that are certainly low belong all to the lowland form and the localities including both forms are the places having the montanic as well as the open lowland areas under the same locality name, such as Shoyoan. The fact seems to suggest that the same relation is true with Korea also.

#### Discussion

Kohl (1906) in his famous monograph of the genus *Ammophila* of the Palaearctic Region admitted *A. infesta* Smith as a close relative of *A. sabulosa* Linné, yet he dealt with each of them as a distinct species respectively, listing several differences observed between them. According to him, *infesta* as compared with *sabulosa* (1) somewhat larger, (2) excavation of frons deeper, (3) with a pair of very distinct lamellate triangular protuberances above base of antennae, (4) collar of pronotum thicker, with anterior aspect perpendicular, (5) punctures on mesonotum more distinct, without rugae or striae, and (6) lacking the toments of silvery pile on tubercles and mesopleurons.

The descriptions well agree with the montanic form, but as to the lowland form items 1, 4, 5 and 6 can not always be in agreement. Items 2 and 3 are also true in the lowland form, but as to (2), the excavation is not so much 'deeper' as 'narrower' on the average. Among the specimens a fair degree of variation can be observed and the character can not be a good specific distinction. Item 3 is certainly an important difference. According to my investigation of some ten specimens of *A. sabulosa* at hand, however, the protuberances are always present, but they are usually very low and indistinct, but in some specimens they are considerably highly raised and distinct. On the other hand, in some of our specimens of the lowland form they are lower than usual, apparently approaching to the state in such specimens as mentioned of *sabulosa*, although the two states can not be crossed with each other. Judging from the facts above related and the consistency of many other characters usually considered as specific it seems to me appropriate to deal with the lowland form as a subspecies of *A. sabulosa*.

On the other hand, the montanic form is apparently considerably different from *sabulosa* as pointed out by Kohl, but when the lowland form is interposed between them it can be connected as a series with *sabulosa*. It has already be mentioned that among the members of each form there are some intermediate forms, sometimes difficult to separate, even in the character of the genital



organs. The fact seems to indicate the high possibility or even the real occurrence of intercrossing between the two forms. This fact, together with the rare observation of such forms also shows that they are in the subspecific relationship, fairly distinctly segregated in habitat. Hence the montanic form should be called *A. sabulosa infesta* Smith and to the lowland and hill form I will give the new subspecific name, *A. sabulosa nipponica*.

Holotype: ♀, Ohno, Fukui Pref., 11. IX. 1967; Paratypes: 10 ♀♀ 10 ♂♂, the same, K. Tsuneki leg.

As to the derivation of the two subspecies in Korea and Japan, to me it seems that at first *nipponica* appeared as a primary geographical race of *sabulosa* and from the former *infesta* was secondarily differentiated as a montanic race. The possible other hypothesis that *infesta* was the preoccupant and it was driven up by the later intruder, *nipponica*, seems to me to have some inconsistency with the actual fact, especially of the subspecific relationship between them.

If my hypothesis is accepted it becomes to present a question as to why such a intermittent distribution from mount to mount has become possible. In order to account for such a distribution, however, there is no need of the same explanation of the distribution as adopted regarding the alpine species. It must be possible to the montanic *infesta* to live in the lowland plain (though they will not do so) and therefore they can be distributed by the wind or casual flight from mount to plain and from plain to mount. Further, it seems also possible even at present that the montanic form may be produced directly from the lowland form. The fact that the near-inter mediate forms of *nipponica* sometimes occur among the inhabitants of the comparatively high areas and those of *infesta* among the members of the low areas seems to give a suggestion toward the possibility of this consideration.

As to why the same montanic form is produced from the separate members of *nipponica* the explanation may be the presumption on the fixation of such a differentiating tendency in *nipponica* as indicated in a large scale among the groups of the Aplacentalia as against the Placentalia of the mammals.

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